

## PERSPECTIVE

# From silos to synergy: Transdisciplinary research as a pathway for population and public health

Tanvir C Turin<sup>1</sup> Kamran U Baset<sup>2</sup> Saidur R Mashreky<sup>3</sup> <sup>1</sup>Department of Family Medicine, Cumming School of Medicine, University of Calgary, Calgary, AB, Canada<sup>2</sup>Department of Public Health, School of Pharmacy and Public Health, Independent University Bangladesh, Dhaka, Bangladesh<sup>3</sup>Department of Public Health, North South University, Dhaka, Bangladesh

## Correspondence

Tanvir C Turin  
turin.chowdhury@ucalgary.ca

## Publication history

Received: 18 Oct 2025  
Accepted: 16 Jan 2026  
Published online: 20 Jan 2026

## Responsible editor

M Mostafa Zaman  
0000-0002-1736-1342

## Reviewers

H: Syed Atiqul Haq  
0000-0003-4154-7283  
I: M Atiqul Haque  
0000-0002-7598-2550

## Keywords

*transdisciplinary, community-engaged research, population and public health*

## Ethical approval

Not applicable

## Funding

None

## Trial registration number

Not applicable

Twenty-first-century population and public health challenges are increasingly complex and interconnected and transcend traditional clinical and disciplinary boundaries. Issues such as climate change, rapid urbanization, rising socioeconomic inequality, and the commercial and digital determinants of health create multi-layered burdens that necessitate a fundamental shift beyond conventional research silos. Transdisciplinary research has emerged as a powerful pathway for population health by embracing knowledge plurality and positioning communities as co-creators of evidence. In the context of Bangladesh, the integration of population and public health with environmental, economic, engineering, governance, behavioral, data-informed, and community-based knowledge perspectives is a necessity for addressing interconnected crises, such as escalating dengue outbreaks and the dual burden of disease. This approach fosters pragmatic frameworks grounded in real-world contexts and ethical accountability, though its implementation must navigate significant institutional barriers and power asymmetries in low- and middle-income contexts. The institutionalization of transdisciplinary platforms offers a timely opportunity for systemic reform, shifting national health responses from silos to synergy. By democratizing knowledge production and aligning diverse sectoral actors, transdisciplinary models can

strengthen health systems and provide scalable, equity-driven lessons for the Global South. Engaging these structural complexities is fundamental to ensuring that transdisciplinary innovation translates into sustained, socially responsive, and resilient population health impacts.

## The complexity of 21st-century health challenges

The health challenges of the 21st century are increasingly complex, interconnected, and shaped by forces that extend far beyond the walls of clinics or laboratories. Issues such as climate change, urbanization, pollution, industrialization, migration, and the growing double burden of disease reveal that no single discipline can generate the solutions needed for sustainable and equitable health outcomes. Bangladesh, similar to many other low- and middle-income countries, exemplifies the epidemiological and structural complexity characteristic of nations undergoing rapid transition [1]. Non-communicable diseases now account for a substantial majority of the national disease burden, while communicable diseases continue to pose significant challenges, resulting in a double burden of diseases [1]. This health burden is further influenced by rapid urban expansion, extreme population density, and climate-related stressors, which converge with shifting cultural and socioeconomic landscapes. These dynamics are increasingly shaped by commercialization, widespread misinformation,

## Key messages

A transdisciplinary research approach is essential for addressing the complexity of population and public health challenges. Moving beyond siloed models, transdisciplinarity integrates academic, governance, behavioral, data-informed, and community-based knowledge through cross-sectoral co-production. This enables context-sensitive, equitable, pragmatic, and sustainable responses to interconnected health, social, and environmental systems. Establishing a national transdisciplinary research platform could strengthen health system responses in Bangladesh while generating globally relevant insights into equity, resilience, and sustainability in population and public health.

and evolving communication paradigms, which, alongside educational disparities and other fundamental determinants, exert sustained pressure on health systems and healthcare access.

#### Transdisciplinary research: Beyond inter- or multi-disciplinarity

Traditional research, often organized within disciplinary silos such as the biomedical sciences, social sciences, environmental sciences, policy studies, or governance, has generated important advances. Yet, the fragmentation of knowledge has also limited our ability to respond effectively to health challenges that are multi-layered, interdependent, and embedded in broader social and ecological systems.

This is where transdisciplinary research [2] emerges as a powerful pathway for population and public health. Unlike multidisciplinary approaches, which involve parallel contributions from different fields, or interdisciplinary approaches, which integrate methods across disciplines, transdisciplinary research goes further. It creates a shared space where diverse academic and systemic actors, such as researchers, policymakers, and practitioners, engage with communities and social actors as partners in inquiry [3] (Table 1). This approach embraces knowledge plurality, acknowledging that solving 21st-century health challenges requires the respectful integration of pluralistic knowledge systems, including scientific, traditional, and context-specific local expertise, to foster a more democratic and robust knowledge production process [4]. Together, they co-produce knowledge, shaping both the questions that are asked and the solutions that are designed [5]. Transdisciplinarity thus transcends disciplinary and

sectoral boundaries to foster pragmatic, real-world grounded frameworks for understanding and acting on complex health problems [3, 5]. At the same time, the implementation of transdisciplinary research is shaped by institutional and sociopolitical realities. Power asymmetries across disciplines and sectors, misaligned academic and funding incentives, and governance arrangements that favor siloed knowledge production can constrain meaningful collaboration and limit the influence of community and civil society voices. Acknowledging these challenges is essential to advancing transdisciplinarity as a context-sensitive and implementable approach rather than a purely aspirational ideal.

#### Why population and public health needs transdisciplinarity

The complexities of population and public health underscore the need for transdisciplinary approaches [6]. Health outcomes are determined by a constellation of various determinants, such as social, economic, cultural, and environmental determinants. For example, tackling non-communicable diseases requires not only biomedical innovation but also insights from behavioral science, urban planning and built environment, and the commercial determinants of health-including the market dynamics of processed, high-sodium, and ultra-processed food industries. Addressing maternal and child health involves gender studies, education, anthropology, and sociology as much as obstetrics and pediatrics. Responding to pandemics demands the convergence of virology, political science, ethics, data science, and community development. In each of these examples, siloed expertise can only go so far; real impact requires transdisciplinary collaboration.

**Table 1** Transdisciplinary research: The core values, guiding principles, defining characteristics, and operationalising practices

Dimension	Illustrative attributes
Core values	<ul style="list-style-type: none"> <li>• Equity and inclusivity – valuing all forms of knowledge and participation</li> <li>• Reciprocity – ensuring mutual benefit and shared responsibility</li> <li>• Reflexivity – examining assumptions, power, and positionality</li> <li>• Accountability – maintaining ethical responsibility to communities and outcomes</li> <li>• Sustainability – nurturing long-term relationships and impacts</li> </ul>
Guiding principles	<ul style="list-style-type: none"> <li>• Co-production of knowledge – integrating disciplinary, professional, and experiential expertise</li> <li>• Boundary crossing – intentionally engaging across academic, policy, and community divides</li> <li>• Contextual relevance – aligning inquiry with cultural and social realities</li> <li>• Systems thinking – addressing interconnected determinants and structures</li> <li>• Mutual learning – fostering collective growth and understanding</li> </ul>
Defining characteristics	<ul style="list-style-type: none"> <li>• Integration – weaving diverse epistemologies and perspectives</li> <li>• Collaboration – co-governed and co-owned processes</li> <li>• Iteration – continuous adaptation through reflection and feedback</li> <li>• Shared governance – equitable structures for decision-making</li> <li>• Action orientation – generating transformative, practice-informed solutions</li> </ul>
Operationalizing practices	<ul style="list-style-type: none"> <li>• Co-design and co-planning – joint problem definition, goal setting, and methodology development</li> <li>• Boundary-spanning facilitation – mediating communication across diverse actors</li> <li>• Participatory governance – inclusion of community, policy, and practitioner voices in decision-making</li> <li>• Iterative reflection and participatory evaluation – learning and adaptation as ongoing processes</li> <li>• Knowledge mobilization and co-implementation – ensuring shared ownership of outcomes and actions</li> </ul>

### Community as co-creator: The ethical and social accountability imperative

Community engagement and involvement are cornerstones of transdisciplinary research work [7]. Research that discounts communities from framing problems and shaping interventions risks irrelevance or even harm. By positioning communities as rights-holders in research and involving them as co-creators rather than passive recipients (Figure 1), transdisciplinary research not only enhances rigor and relevance but also contributes to decolonizing and democratizing knowledge production. This “research with, not on” ethos ensures that community voices are centered for ethical and effective knowledge creation, although its operationalization must navigate social stratification, risks of tokenism or cultural appropriation, gender norms, and political mediation through genuinely inclusive facilitation practices [8].

### The case for transdisciplinarity in Bangladesh

Against this conceptual backdrop, Bangladesh represents a particularly salient context in which to consider both the promise and the limits of transdisciplinary approaches. Bangladesh's ongoing epidemiological transition and structural vulnerabilities do not exist in isolation; rather, they manifest as intersecting systems spanning biomedical, socio-ecological, and political-economic domains. For example, the escalating frequency of

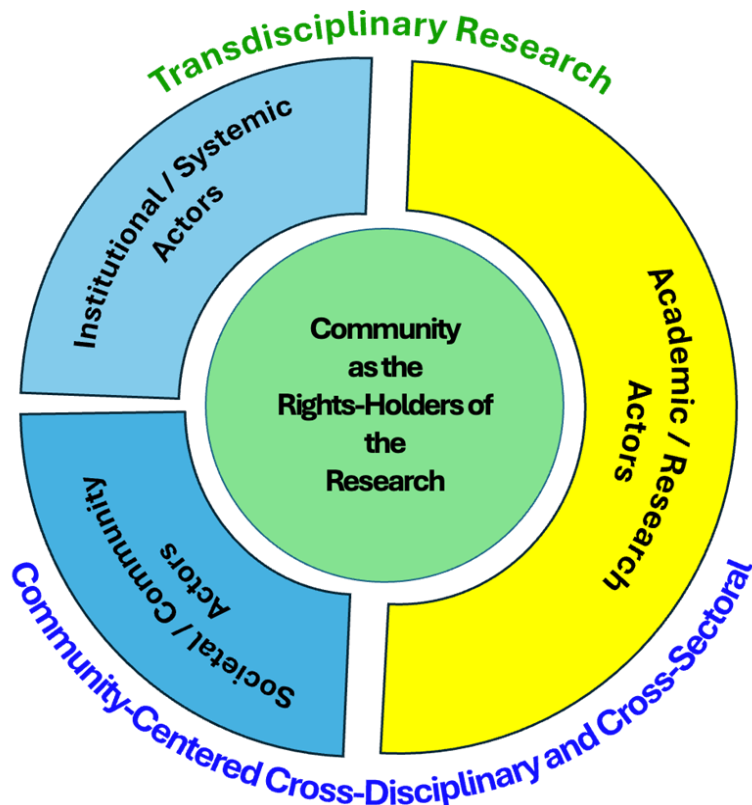
dengue outbreaks, driven by the interaction of unplanned waste disposal systems, the rapid proliferation of construction-related breeding sites, and shifting monsoon patterns, reveals the presence of deeply embedded upstream determinants that defy narrowly defined disciplinary categories.

In light of this complexity, Bangladesh presents a compelling context for advancing transdisciplinary models of population and public health research. Rather than treating epidemiological transition and climate vulnerability as discrete phenomena, they can be understood as components of an interconnected socio-ecological system that invites innovative, multisectoral collaboration. The dynamics of dengue outbreaks, while challenging, illustrate the opportunity to align urban waste management, infrastructure engineering, and community-led environmental monitoring within a unified preventive framework. This interconnectedness suggests that population and public health equity in Bangladesh is a shared product of the broader public sphere. Social determinants, health policy and governance, education, commercial forces, and environmental conditions are not merely contextual factors but primary drivers of population health. Recognizing this interdependence enables movement beyond isolated medical interventions toward a “Health in All Policies” approach that leverages the strengths of multiple sectors. In such a landscape, population health can be co-produced through the synergy of policy innovation, engineering resilience, and clinical expertise.

While institutional silos have historically constrained collaboration in Bangladesh, there is an increasing need to transcend these traditional boundaries to achieve sustainable development. Evolving beyond fragmented mandates and hierarchical structures requires academic and policy environments to place greater value on integrating community-centered knowledge with scientific expertise. Embracing a transdisciplinary approach, one that intentionally harmonizes diverse sectors and democratizes the research process, is increasingly a necessity for Bangladesh to address their own interconnected population and public health challenges and to develop socially responsive, resilient, and durable solutions.

### A call to action: Building synergy for the future

As Bangladesh advances in the global health research landscape, establishing a transdisciplinary research platform in population and public health presents a timely opportunity. Such a platform would unite scholars across disciplines, bridging the population and public health with the environmental, economic, social, and engineering sciences, alongside law and policy experts, while ensuring communities are active partners in shaping research agendas. By moving “from silos to synergy”, Bangladesh can strengthen its



**Figure 1** Community centered cross—disciplinary and-sectoral transdisciplinary research actors

health systems and offer scalable, equity-driven lessons to the Global South on how transdisciplinary approaches advance resilience and sustainability. At the same time, the institutional and structural challenges outlined above point to critical areas for deeper inquiry, methodological innovation, and systemic reform. Engaging these complexities more fully will be required to translate the promise of transdisciplinarity into sustained population and public health impact. To realize this, we call on academic institutions, funders, and policymakers to prioritize transdisciplinary research through dedicated funding, institutional support, and enabling policies. Researchers must step beyond disciplinary boundaries to engage meaningfully with practitioners, decision-makers, and communities to co-produce the knowledge systems required for a more equitable and resilient future.

#### Acknowledgments

We (the authors) take full responsibility for the content of this paper. We acknowledge the use of AI (perplexity.ai) for assistance with English language editing. We used prompts to improve the structure of sentences that we deemed could be further improved. AI was prompted to improve clarity by improving grammar and choice of vocabularies used in the text. All suggestions were critically reviewed and revised to uphold the reliability and precision of the write-up. Additionally, we ensured the integrity of our own expressions with careful consideration.

#### Author contributions

*Manuscript drafting and revising it critically:* TCT, KUB, SRM. *Approval of the final version of the manuscript:* TCT, KUB and SRM. *Guarantor of accuracy and integrity of the work:* TCT, KUB, SRM.

#### Conflict of interest

We do not have any conflict of interest.

#### Data availability statement

We confirm that the data supporting the findings of the study will be shared upon reasonable request.

#### AI disclosure

None

#### Supplementary file

None

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